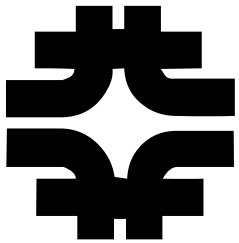
On Luminosity vs Injected Proton/pbar Intensities



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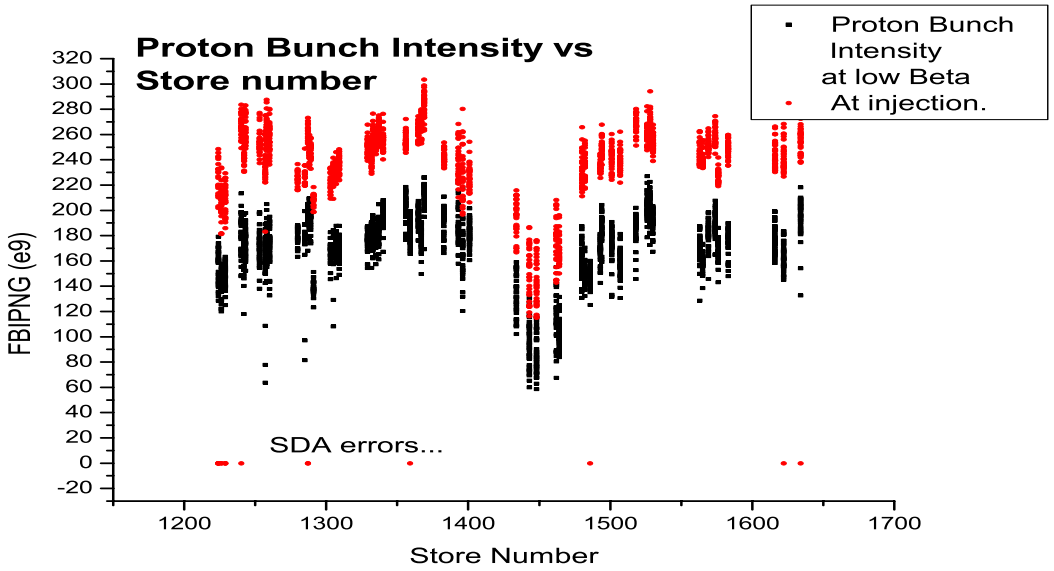
Do we significantly Improve the luminosity by injecting more protons?

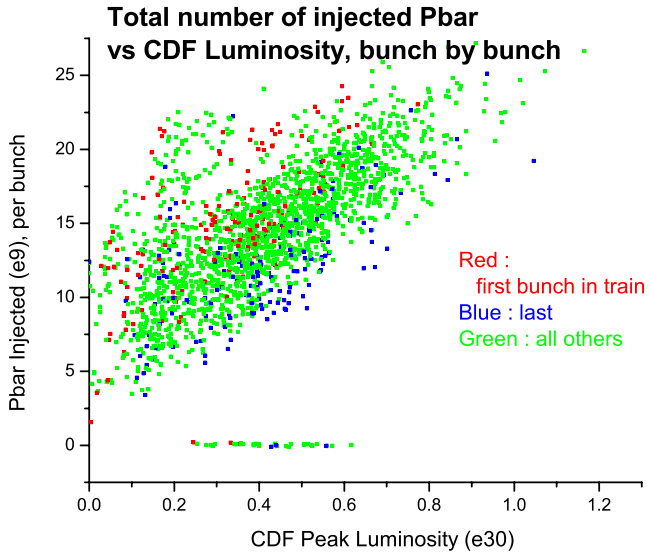
- In theory, Evidently Yes.
- → Above ~ 250 to 300 e9 per bunches, in practice, this is not so clear!

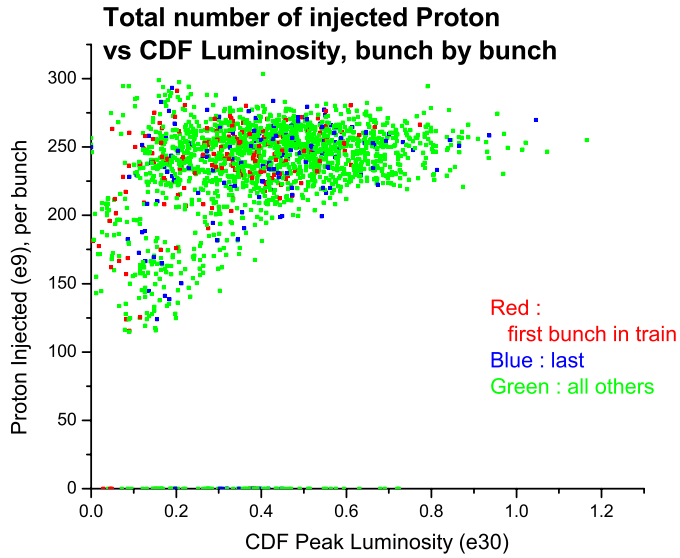
Proton Intensities, injected, ***for successful store***



We unfortunately don't have that many store at low intensity (we don't bother) and not enough at high intensity (we tend to loose them!)

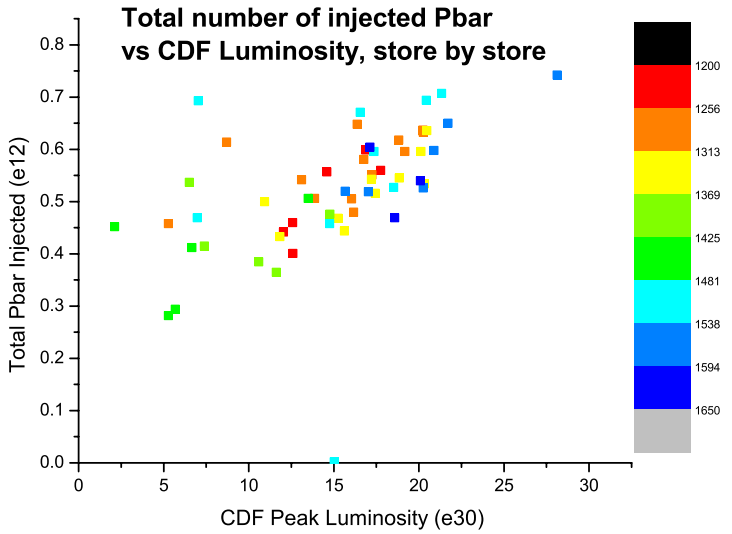
Luminosity vs Injected Bunch Intensity

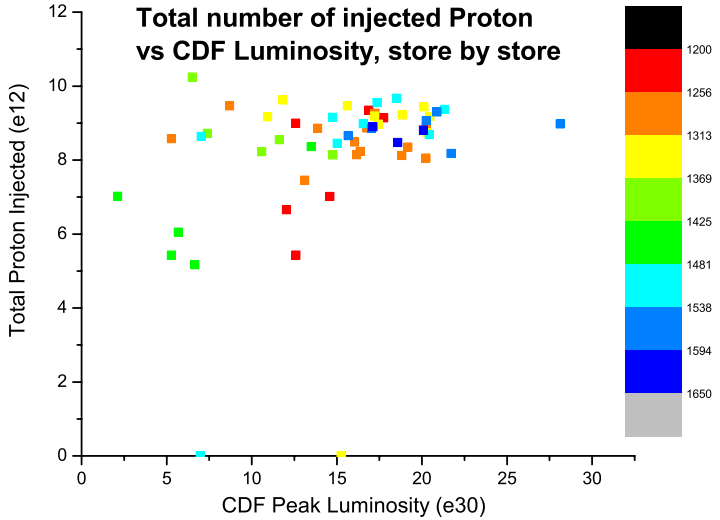




Injected Intensities are measure a few seconds after injection of respective Bunches. Luminosity is measured by CDF, bunch by bunch.

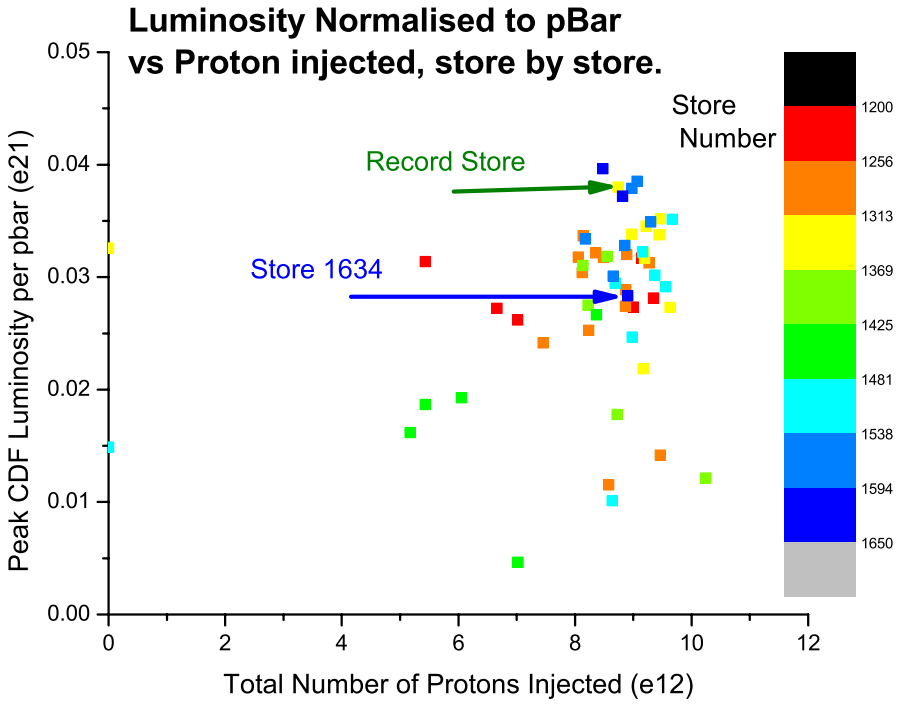
Luminosity vs Injected Bunch Intensity, II





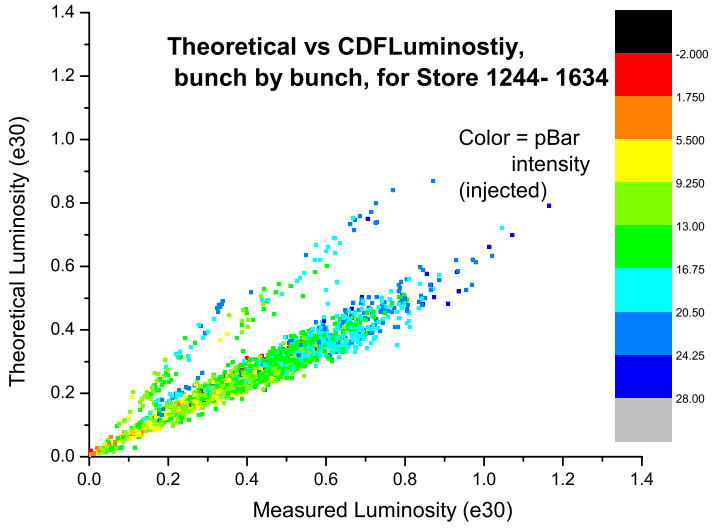
The pattern is observed averaging over all bunches within a store. Note the record luminosity store was obtained at the average proton intensity, no higher.

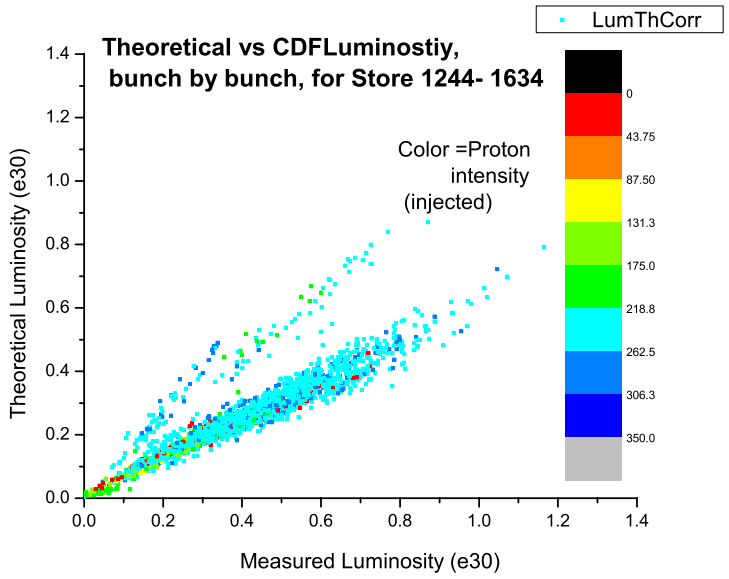
Luminosity Normalized to Pbar bunch Intensity



The Peak Luminosity At CDF, normalized by the pbar intensity can fluctuate by ~ 50 to 100 % depending on emittances an overall tune of the machine, ***for the same total proton intensity***

Do we understand this what goes into Luminosity ?





Note: theoretical number are based on an effective beta* of 41 cm. We think the beta* is in fact 35.6 cm, and we could be focusing in X and Y at different Z location. Thus, increase by 15%, or more (hour Glass factor) could be legitimate. Also, this is based on vertical emittance only, we assumed X and Y emittance are equal.

Conclusion

- At moderately high proton intensity (almost factor 2 below RunII goals!), there is no evidence we gain in luminosity with proton intensity.
- The record store was both due emittance/tuning and record number of injected number of pbar, not more proton than usual.
- We start seeing bunch number in the train dependencies.
- There is more to study in the data!